MAKING REGOLITH

Student Section Student Name _____

In this lesson you will make simulated regolith and observe its properties.

During this lesson, you will

- investigate the effects of micrometeoroid bombardment on regolith formation.
- develop a conclusion by making inferences about properties of regolith based upon observations.

Problem

How does the bombardment of micrometeoroids make regolith on the moon?

Observation

A fine dust called regolith covers the moon. The bombardment of micrometeoroids broke the moon's rocks into very tiny pieces, creating regolith. Scientists have studied samples from the moon to learn more about the moon and to continue exploring space.

Lunar regolith is about one fifth (1/5) metals and one fifth (1/5) silicon. The rest is mostly oxygen. NASA is looking for ways to pull oxygen from the moon's surface. Oxygen as a gas could one day support a human base on the moon and fuel vehicles designed to land on and launch from the moon. The particles in lunar regolith are very small (usually less than 0.1 millimeters across).

In this activity, you will make and study simulated regolith samples to observe their properties.

Use the first column of this KWL chart to organize your observations about regolith. Brainstorm with your group what you want to know about regolith, then list in the second column of this KWL chart.

KNOW	WANT TO KNOW	LEARNED

Hypothesis

Based on your observations, answer the "problem question" with your best guess about what will happen. (How does the bombardment of micrometeoroids make regolith on the moon?) Your hypothesis should be written as a statement.

My hypothesis: _____

MATERIALS

Per student

- 1 pair of safety glasses

Per group

- 1 microscope or magnifier
- 1 box lid (shoe box size)
- 1 larger box or lid that the small box lid can be placed inside
- cinnamon sugar graham crackers (enough to line the bottom of the small box)
- 3-4 white powdered sugar, cake mini-donuts (one per student)
- newspapers
- 3 index cards
- clear packing tape
- 2 different sized wire strainers (colander, tea strainer, etc) or 2 pieces of different sized wire screens
- 1 pair of scissors
- 4 containers for holding sifted regolith
- 1 hole punch
- 1 marker

SAFETY

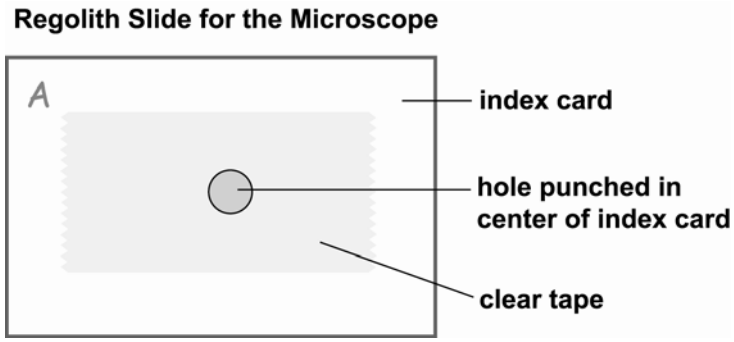
Review your classroom and lab safety rules.

- Put on safety glasses when instructed.

Test

1. Put on your safety glasses.
2. In an open area, spread newspaper on the floor. On the newspaper, place the small box lid inside the larger box lid.
3. Spread an even layer of graham crackers on the bottom of the small box lid, simulating the bedrock on the moon. Crush a few graham crackers into very small crumbs and place on top of the bedrock layer. This simulates the moon's regolith.
4. Let the white powdered sugar, cake mini-donut (micrometeoroid) fall from your hand, from way above your head and into the box with the graham crackers. This "donut dropping" simulates the bombardment of micrometeoroids on the moon.
5. Continue taking turns with your group members, dropping the same donut (micrometeoroid) onto the surface of the moon until regolith is formed (the graham crackers and donuts are crumbs). When the bombardment is finished, the crumbled and broken donuts should stay in the box with the bedrock and regolith.

6. Observe the regolith sample in your box carefully, using the properties your teacher asked you to use. **Record** your data on the Making Regolith Data Chart.
7. With the marker, label the four containers with: “Sample A”, “Sample B”, “Sample C” and “Bedrock”.
8. Remove any piece from your box lid that measures one inch or more, and place them in a container labeled “Bedrock”.
9. Using the strainer with the largest holes, sift your regolith sample that is inside the box lid into a clean container (use your other box or lid). Save the large pieces that were caught in the strainer and place these pieces in the container labeled “Sample A”.
10. Take what was sifted out of the largest strainer, and sift that with a strainer with smaller holes. Save the pieces that were caught in the strainer and place these pieces in the container labeled “Sample B”.
11. Take what was sifted out of the smaller strainer and put it into the container labeled “Sample C”.
12. Observe each individual regolith “grain” sample (Samples A – C) carefully, using the properties your teacher asked you to use earlier. Record your data on the Making Regolith Data Sheet.
13. Use the hole punch to make a small circle in the center of three index cards. (See diagram.)
14. Cover one side of the hole with clear tape.
15. Trim the index card with scissors so that it fits on the stage of the microscope.
16. Turn the card so the sticky side of the tape is facing up.
17. Label the cards A, B, and C with the marker.
18. Sprinkle a small amount of each sifted regolith sample on the sticky side of the tape, making one slide for each sample. The sample from container “A” should be placed on the index card marked “A”, the sample from container “B” should be placed on the index card marked “B”, and the same for container “C”.
19. Turn the index card on its side and shake off the extra regolith back into the container.
20. Use your magnifying glass or microscope to carefully examine each simulated regolith sample. Make sure you look for all the observable properties you used previously. **Record** all properties on your Making Regolith Data Sheet. Be sure to draw and describe what you see in your field of view for each sample.



Study Data

After making all your observations on the Making Regolith Data Sheet, study the data by answering the following questions.

1. Based upon your observations, how was your regolith formed? What connection does regolith have to bedrock?

2. How is regolith made on the moon?

3. Compare Earth's soil to what you know about regolith on the moon.

4. What could we learn about other planets by comparing their regolith to Earth's soil?

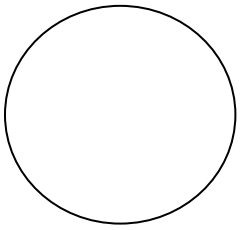
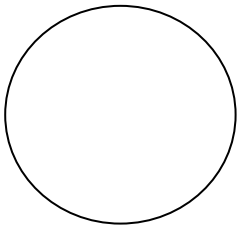
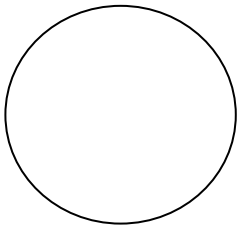
5. Does this data support your hypothesis? Why or why not?

6. How does the atmosphere protect the Earth from this same micrometeoroid bombardment that takes place on the moon?

Conclusion

- Update the LEARNED column in your KWL chart.
- Restate your hypothesis and explain how the results do, or do not, support your hypothesis.

Making Regolith Data Sheet

Observations	Regolith Sample before it is separated		
Before sifting the samples, describe the properties of the regolith without using a magnifier or microscope.			
Observations	**Sample A Large Pieces**	**Sample B Medium Pieces**	**Sample C Small Pieces**
After sifting the regolith, what properties can you describe without using a magnifier or microscope?			
Using the magnifier or microscope, describe what you see using sketches and words.	**Sketch:**  Field of view	**Sketch:**  Field of view	**Sketch:**  Field of view
	Describe:	**Describe:**	**Describe:**

Scientific Investigation Rubric

Activity: MAKING REGOLITH

Student Name _____ Date _____

Performance Indicator	0	1	2	3	4
The student developed a clear and complete hypothesis.					
The student followed all lab safety rules and directions.					
The student followed the scientific method.					
The student recorded all data on the data sheet and drew a conclusion based on the data.					
The student asked engaging questions related to the study.					
The student described at least one way that this observation related to the exploration of other moons and planets.					
Point Total					

Point total from above: _____ / (24 possible)

Grade for this investigation _____

Grading Scale:

A = 22 - 24 points

B = 19 - 21 points

C = 16 - 18 points

D = 13 - 15 points

F = 0 - 12 points